



Contribution ID: 159

Type: Talk

## **【125】 Benchmarking digital quantum simulations and optimization above hundreds of qubits using quantum critical dynamics**

*Friday 13 September 2024 14:15 (15 minutes)*

We utilize known theoretical results about many-body quantum critical dynamics to benchmark quantum hardware and various error mitigation techniques on up to 133 qubits. In particular, we benchmark against known universal scaling laws in the Hamiltonian simulation of a time-dependent transverse-field Ising Hamiltonian. Incorporating basic error mitigation and suppression, our study shows coherent control up to a two-qubit gate depth of 28, featuring a maximum of 1396 two-qubit gates, before noise becomes prevalent. These results are transferable to applications such as digitized quantum annealing and match the results of a 133-site optimization, where we identify an optimal working point in terms of both circuit depth and time step.

**Author:** MIESSEN, Alexander (IBM Quantum, IBM Research –Zurich; Institute for Computational Science, University of Zurich)

**Co-authors:** EGGER, Daniel (IBM Quantum, IBM Research –Zurich); TAVERNELLI, Ivano (IBM Quantum, IBM Research –Zurich); Prof. MAZZOLA, Guglielmo (Institute for Computational Science, University of Zurich)

**Presenter:** MIESSEN, Alexander (IBM Quantum, IBM Research –Zurich; Institute for Computational Science, University of Zurich)

**Session Classification:** Condensed Matter Physics (KOND)

**Track Classification:** Condensed Matter Physics (KOND)